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NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION
PATUXENT RIVER, MARYLAND

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THIRD PARTY RISK ASSESSMENT TOOL (3PRAT)

by

Michael Knott
Roland Cochran
Dr. David Burke

10 July 2012

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DEPARTMENT OF THE NAVY
NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION
PATUXENT RIVER, MARYLAND

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14. ABSTRACT This report provides an overview of work sponsored by Office of Secretary of Defense to develop a consistent calculation method to determine the Target Level of Safety to uninvolved 3rd parties posed by the operation of a Unmanned Aerial System. A summary of the key calculations and assumptions is provided as well as reference to reports containing more detailed information on the key areas.			
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SUMMARY

One of the critical requirements for expanding the operational area of Unmanned Aerial Systems (UAS) is to understand the risk to uninvolved third parties on the ground posed by the crash of a UAS. This report provides an overview of work sponsored by Office of Secretary of Defense to develop a consistent calculation method to determine the Target Level of Safety (TLS) to uninvolved 3rd parties posed by the operation of a UAS. A summary of the method, key calculations and assumptions is provided as well as reference to reports containing more detailed information on the major components of the TLS methodology. As a result of this work, a 3rd Party Risk Assessment Tool was developed and is available for use along with a user guide to provide step-by-step instructions.

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INTRODUCTION

Over the past several years, Unmanned Aerial Systems (UASs) have proven their value in military combat zones; however, operating UASs within the National Airspace (NAS) has been met with several challenges. Due to limited experience with UAS compared to manned aircraft, the risks of operation are higher. Due to these higher risks, operation of UAS has been restricted to sparsely populated areas, restricted airspace, maritime environments, and combat zones. These restrictions limit the usefulness of UAS, limit training opportunities and limit basing options for UAS. The Department of Defense (DOD) would like to expand the areas in which UAS can operate, in order to do this, a means to understand the risks must be developed. In the near future, both commercial and Military UAS operations over the continental U.S. are going to drastically increase. As the volume of traffic in the skies increase, so does the inherent risk of flying. Before clearance can be given for UASs to fly in the NAS, the risks of UAS operations to the public must be well understood.

One of the critical requirements for expanding the operational area of UAS is to understand the risk to uninvolved third parties on the ground posed by the crash of a UAS. In order to address this issue, Office of Secretary of Defense (OSD), Strategic and Tactical Systems – Unmanned Warfare office, Air Worthiness IPT has sponsored the Target Level of Safety (TLS) to Third Parties program. The objective of this program is to define a consistent calculation method to determine the relationship between UAS reliability, potential to cause damage and where it flies. NAVAIR (AIR-4.3.1) has led the effort to develop this methodology. The TLS Program includes five modules; Casualty Expectation, Probability of Loss of Aircraft, Potential Crash Location, Lethal Crash Area (LCA), and Population Density.

There are multiple risks associated with flying. Some examples include: the risk of aircraft failure to people on board the aircraft, the risk of a midair collision to people onboard the aircraft, and the risk to 2nd and 3rd parties of aircraft mishaps. In risk assessment models for aircraft, there are three levels of personnel and the level of risk that they assume. The first level is composed of persons flying in aircraft to include: pilots, crew, and passengers. These individuals are in the highest risk during a flight termination condition; however, upon boarding the aircraft, Level 1 personnel have assumed the risks of flying. The second set of individuals, Level 2, consists of those who knowingly work or operate around facilities that accommodate aircraft. Examples of these individuals include ground crews, all personnel on a U.S. Navy carrier deck, people who work on the ramp of an airport, and air traffic controllers who have training and knowledge with regard to flight operations. The final level, Level 3 or 3rd party individuals consist of those individuals who do not fall into Levels 1 or 2. 3rd party individuals compose of the vast majority of the general population who do not work on or around aircraft. Due to the nature of aviation, as aircraft fly overhead, there is an assumed risk accepted by 3rd parties due to aviation operations.

For military aircraft, service specific Safety Centers track mishap data for each type of aircraft in the fleet. The risks associated with flying either commercial or civilian aircraft is clearly quantified and defined by statistics taken by the National Transportation Safety Board and the Federal Aviation Administration (FAA). Historically, risk associated with aircraft operations is

calculated from data on number of flight-hours and number of mishaps for a given type of aircraft. Since UASs are much less mature than other elements of aviation, the risk associated with UAS operations is currently unknown.

This work focuses primarily on the risk of operations as it relates to 3rd parties on the ground. To accomplish this, a risk assessment tool called the 3rd Party Risk Analysis Tool (3PRAT) has been developed using the program MATLAB. By using the 3PRAT, the risk, also defined as the Level of Safety (LOS), can be quantified for any aviation asset flying over NAS. It is important to note that the 3PRAT can be used for any heavier than air aircraft, manned or unmanned, fixed wing or rotor wing. The end goal of the analysis done with the 3PRAT is to quantify the risk associated with air operations for 3rd parties on the ground. The LoS generated from the 3PRAT will then be compared to a TLS to determine if the UAS mission satisfies the TLS requirement.

LEVEL OF SAFETY

The goal of the 3PRAT is to determine the risk or LoS associated with the operation of various types of aircraft. The 3PRAT calculates the risk of 3rd party fatalities on the ground given specific aircraft operating conditions. LoS has the units of falities per 100,000 flight-hours. Reporting mishaps and fatalities per 100,000 flight-hours is a common standard for mishap reporting used by both the U.S. DOD and the FAA. To determine the LoS for UAS operations, there are many variables that must be taken into account.

To determine the risk of fatalities to third parties on the ground, it must first be determined what the risk of aircraft loss or the Probability of Loss of Aircraft (PLoA) is. Given PLoA, it must then be determined what the risk of fatalities or the Probability of Casualties (PoCA) are given that an aircraft has been lost. The LoS is a function of PLoA and PoCA and can be defined using equation 1.

$$LoS = PLoA * PoCA \qquad (1)$$

where:

LoS = Level of Safety (fatalities per 100,000 flight-hours)
PLoA = Probability of Loss of Aircraft (loss per 100,000 flight-hours)
PoCA = Probability of Casualty (fatalities per loss)

PLoA and PoCA are complex functions that take many variables into account. Each variable must be evaluated to accurately determine the LoS of air operations.

PROBABILITY OF LOSS OF AIRCRAFT

The risk of aircraft loss or the PLoA is typically given as losses per 100,000 flight-hours. This number can be generated in one of two different ways: a reliability block diagram method, or by historical data. The easiest and most accurate method for determining the PLoA of an aircraft is to use historical data. This is accomplished by simply accounting for the number of mishaps an aircraft platform has over a given period of time. The mishap rate is then divided by the number of flight-hours the platform occurs over the same period of time. The DOD, as well as the FAA, have very good record keeping and maintain these statistics for both military and commercial

aviation. In the military, each branch's respective Safety Centers maintain the mishap rates of all of the aircraft platforms in the branches inventory. In the case of new or very immature aircraft, mishap rates may be unknown. This occurs whenever flight-hours flown are inadequate to accurately represent the platform. In this case, a Reliability Block Diagram (RBD) method can be used to determine PLoA.

The RBD method analyzes each subsystem of an aircraft to determine the probability of failure of the subsystem and, as a result, the probability of failure of the aircraft. The subsystems evaluated in the RBD method include all the systems that could result in the loss of the aircraft and consist of systems like: avionics, power and propulsion, flight controls, etc. Each critical component in each subsystem is evaluated to determine the reliability of that component. Once that is accomplished, a RBD is created. By entering each component's reliability into a RBD, the overall reliability of the subsystem is established. By using the reliability of each subsystem, the reliability of the overall aircraft can be determined.

While the RBD provides the reliability of the aircraft, historical data show that the reliability generated from an RBD does not accurately represent historical mishap rates. Typically, reliability numbers generated from reliability block diagrams can be as much as an order of magnitude less than historical figures. This has to do with the fact that the RBD method only evaluates the reliability of the parts of the aircraft. The RBD method only determines what the mechanical reliability of the system is, it does not take into account human factors. Human factors include things such as pilot error, maintenance malpractice, and adverse human/system interaction. Data collected from the Air Force shows that human factors are actually the leading cause of mishaps in UASs. A study conducted by the Air Force in 2005 concluded that 60.2% of all UAS mishaps studied were human related (reference 1).

By using the RBD method, more than half of the UAS mishaps studied by the Air Force would not have been captured. As a result, it is recommended that the historical figures be used when evaluating LOS. In the cases where historical figures are not established, or in the case where they are not statistically relevant, the RBD method can be used. If the RBD method is used, it is recommended that a weighting method be developed to take into account human factors into the mishap rate.

PROBABILITY OF CASUALTIES

Once the PLoA of a platform has been determined, it must be determined what the PoCA to 3rd parties on the ground is. PoCA evaluates what the expectation of casualties is given that a mishap has occurred and is a function of the LCA, and of the population density of the PCA. PoCA is defined by equation 2 and has the units of fatalities per mishap.

$$PoCA = LCA * Population\ Density \qquad (2)$$

where:

PoCA = Probability of Casualty (fatalities per mishap)
LCA = Lethal Crash Area of Aircraft (square miles)
Population Density = The average population density within the PCA (people per square miles)

LETHAL CRASH AREA

The LCA component in the equation above represents the area of a crash site that one would expect to experience casualties. The LCA is calculated within the 3PRAT and is a function of aircraft type, size, weight, fuel load, and expected shelter available for personnel within the crash area. In determining the LCA, prior to analyzing the UAS, one must begin with an examination of the susceptibility of the human body to various injury mechanisms. Through literature research and analysis, a lethal threshold was established and determined to be 54 ft-lb.

With human tolerances defined, the likely LCA of a UAS must be determined. The LCA calculation focused on impacts for four primary modes of aircraft accidents: Fixed Wing Vertical Impact, Fixed Wing Glide Impact, Rotary Wing Vertical Impact, and Rotary Wing Glide or Autorotation Impact. Models were constructed using assumptions gained from literature research, affirmation of physics based equations, and the analysis of actual flight incidents. These models were then built into the 3PRAT to verify that the algorithms could produce a reasonably accurate yet simplistic tool for the purposes of determining LCA.

The researchers then examined the effects to which shelter can alleviate some of the dangers to UAS crashes. Shelter calculations were determined by collecting data provided by the DOD Explosives Safety Board. The algorithms were compared to three case studies of manned vehicles that impacted different shelters, the resulting fallout, and the accuracy of the model to predict the amount of energy the shelter absorbed during the crash. Finally, standard shelter size and materials were identified for both rural and urban cases.

In addition to determining the lethal kinetic energy threshold, modeling the different aircraft crash modes and determining the effects of shelter the effect of explosion and fire resulting from crash was also evaluated. The investigation of energetic sources centered mainly on the analysis of the potential fuel onboard the aircraft. At first, the effects of explosions were examined for the lethal area; however, this was eventually not used due to its smaller size as compared to the burning effect of the fuel. For both blast-impulse and fireball, the size of the lethal area was less than that of the impact area of the vehicle and much less than the burn radius of the aircraft due to fuel spillage.

A more likely source of injury and lethality to 3rd persons was the effects of primary and secondary fires due to unspent aviation fuel. Using algorithms provided by the Department of Energy, the amount of heat released from a resultant fire in a crash could be determined. This was then correlated with the time it takes human tissue to burn as well as fatality studies that relate burn amount to lethality. The result for air vehicles that carry large amounts of fuel, the lethal area due to fire induced burns can extend beyond the physical crash site of the aircraft.

By taking into account all of the appropriate data, the LCA was calculated. For a more detailed explanation of the methods used to determine the LCA, please refer to the report: Crash Lethality Model (reference 2). This report goes into the specifics of each calculation and assumption made to determine the LCA. The report also lists some examples and works through finding the LCA for various UASs in varying crash conditions.

POTENTIAL CRASH AREA

In looking at equation 2, PoCA is a function of the LCA and population density. The population density referenced in equation 2 relates to the population density of the PCA of the aircraft. In order to define the population density, first the PCA must be established. The PCA of an aircraft is the potential area that the aircraft can land following a catastrophic failure. It is virtually impossible to know exactly where an aircraft is going to crash. As a result, the PCA for an aircraft must be determined.

It was found that there are multiple approaches for modeling the PCA of an aircraft after a catastrophic failure. After some literature research, it was determined that the Clothier model would be used for fixed wing aircraft and that a classical physics model would be used for rotary wing aircraft. Clothier uses a high fidelity dynamic model of a generic aircraft to determine the maximum potential distance an aircraft can fly after no power or control inputs are supplied to the aircraft (reference 3).

Clothier uses a 6-degree of freedom model to find the footprint boundaries for gliding decent using differing aircraft parameters. Clothier first makes some assumptions which are used to simplify the equations of motion. The first assumption taken by Clothier is that the aircraft maintains coordinated flight and that the transitions between trim states are instantaneous. Therefore, the trajectories generated by the model represent the ideal trajectories that can be achieved. It is also assumed that the aircraft has simple wing geometry, constant descent velocity, balanced flight (lift force equals weight), no wind, rigid body dynamics, small angles of attack, small thrust angle, and a constant sea level atmosphere. Without making these assumptions, the model would be prohibitively complex and the variable stack up would have made the model virtually impossible to solve.

By using the maximum lift to drag ratio and the velocity of the aircraft, Clothier was able to determine the extremes of the footprint boundaries for a gliding descent. Clothier found that footprint area grows uniformly as the height above ground level increases. At low altitudes, the footprint looks more like a circular sector and as altitude increases the footprint looks more like an ellipse. The footprint shape and area also varies with different aircraft, mainly the difference in maximum lift to drag (L/D) ratios. The higher the aircraft L/D ratio, the larger the footprint area is estimated to be. In addition to the L/D ratio, velocity affected the PCA. As velocity increases, the less circular the footprint becomes. The model developed by Clothier was then verified against known aircraft. The geometry of his model can be seen in Figure 1.

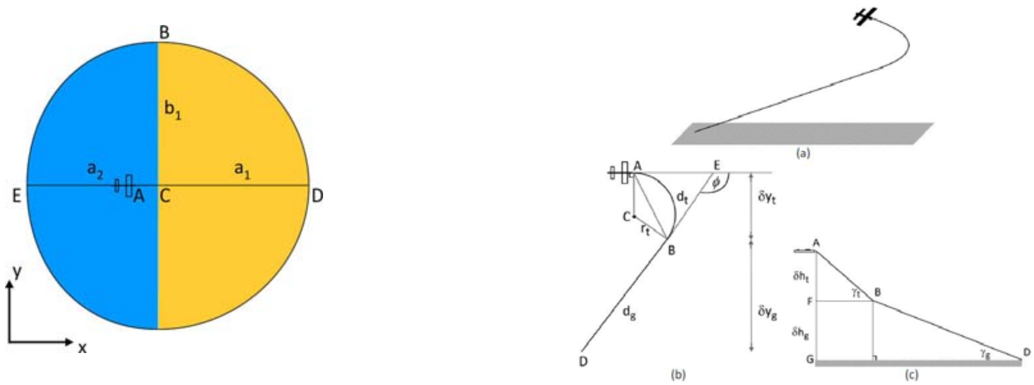

Figure 1: Illustration of Dual Half-Ellipse Geometric Footprint Primitive

Note that A is the initial aircraft location, AC is the turn radius r_t for the chosen bank angle, CD = a_1, CB = b_1 = b_2, EC = a_2. C is the centre point for the frontal and back ellipse. In Figure 1, A is the origin; E, B, and D are extremities. Thus, a_1, b_1, and a_2 can be used to approximate the extremities of the true footprint. C is the center of both ellipses, and C is distance r_t from A.

$$a_1 = maximum\ distance - r_t$$
$$b_1 = r_t + distance\ of\ glide$$
$$a_2 = r_t + distance\ of\ glide$$

The above method was used for fixed wing aircraft; however, for rotary wing aircraft, classical physics was used to model the PCA. Currently, there are no helicopter models that the authors could find that can find the crash location using flight information and different types of crash trajectories. As a result, an assumption was made that simplified the problem into something very manageable. By assuming no autorotation for a helicopter crash, the PCA simplifies into a very simple classical physics problem. Without autorotation, the helicopter crash trajectory simply becomes projectile motion. This makes lift and drag negligible and also insures that majority of the force of the crash will be the vertical direction. By using the height and airspeed of the aircraft, the radius of the PCA simplifies into equation 3.

$$R = V_0\sqrt{\frac{2h}{g}} \qquad (3)$$

where:

R = Radius of PCA
Vo = Helicopter speed at loss of control.
H = Altitude of helicopter at loss of control
G = gravitational constant

By using the two methods above, the PCA can be calculated for either a fixed wing or a rotary wing aircraft. For more details on the methodology used above, refer to the report: Potential Crash Location Model (reference 4). Once the PCA of an aircraft is determined, the next step in defining the population density of the PCA.

POPULATION DENSITY

Given that the PCA for an aircraft has been determined, the average population density bounded within the PCA must be calculated. To determine the population for the PCA, data collected from the U.S. Census Bureau was used. The population of the U.S. is analyzed by the Census Bureau every 10 years when the U.S. Census is conducted. The census data were the foundation data used for the calculations needed to calculate the population density. Due to the fact that the TLS tool is primarily concerned with the risk to 3rd parties on the ground within the national airspace, the Continental U.S. was the land mass analyzed for the tool. Alaska, Hawaii, or any territories of the U.S. was not analyzed. To determine the population density of an area, the following equation was used.

$$PopDen = Pop/Area \qquad (4)$$

where:

PopDen = Population Density (people per square mile)
Pop = Population (people)
Area = Area (square miles)

By using data downloaded from the U.S. Census Bureau, the 3PRAT was used to process the data. Census data are available free from the Census Bureau in many resolutions. The census tract shapefiles were downloaded and used due to their ideal resolution. By using the PCA geometry calculated using the method above, MATLAB was used to constrain the census tracts that fell within the PCA.

Within MATLAB, the inpolygon function was used to evaluate the geometry of the PCA against the geometry of the census tracts contained within the shapefiles downloaded from the Census Bureau. By using the inpolygon function, MATLAB was able to determine if the aircraft's PCA fell within a specific census tract and/or if a census tract fell within the PCA. This had to be done due to the varying sizes of both census tracts and the PCAs. In more rural areas, the resolution of census tracts increases. As a fixed wing aircraft flys lower to the ground, the size of the PCA decreased. It was also found that rotary wing aircraft had much smaller PCAs compared to fixed wing aircraft.

Once the inpolygon function constrained the appropriate census tracts bound by the PCA, the tract area and population data were called out from the shapefile and processed. By taking the population data and dividing it by the tract area as shown by equation 4, the population density was determined for the length of a flight. For more detailed information regarding how the population density was determined for the 3PRAT, refer to Population Density Modeling Tool (reference 5).

LEVEL OF SAFETY

With both the PLoA of an aircraft defined and the PoCA defined for given flight conditions, the LoS can be calculated by using equation 1. By using the MATLAB-based 3PRAT, calculating PoCA is a seamless process. It is important to note, that while flying, it is assumed that the PLoA and the LCA of the aircraft stays constant. With that being said, the only variable in the LoS

equation that does not remain constant is population density. As a result, the LoS profile for a given flight is going to be directly proportional to the population density profile of a flight plan. Minimizing the risk of a flight means minimizing the population density of the area an aircraft flies over. This means avoiding major cities and metropolitan areas.

3rd PARTY RISK ASSESSMENT TOOL

The 3PRAT integrates the models described above into a user friendly, flexible transparent system to calculate the LoS associated with operating a UAS in the NAS. The tool provides an order of magnitude estimate for LoS based on user selected inputs for PLoA, flight path, aircraft geometry, and operations. The 3PRAT provides a solution to the objective of the OSD TLS program as a consistent method to determine the relationship between UAS reliability, where it flies, and potential to cause damage.

A copy of the tool is available from the authors. A 3PRAT user guide, providing step-by-step instructions for use of the tool as well as worked out examples of a UAS flight is available in the 3PRAT User Guide (reference 6).

REFERENCES

1. Thompson, William, U.S. Military Unmanned Aerial Vehicle Mishaps: Assessment of the Role of Human Factors Using Human Factors Analysis and Classification System (HFACS), HSW-PE-BR-TR-2005-0001, U.S. Air Force Human Systems Wing, San Antonio TX, 2005.

2. NAWCAD Patuxent River Technical Report No. NAWCADPAX/TR-2012/196, Crash Lethality Model, of 6 Jun 2012.

3. Clothier, Reece, et al. A Casualty Risk Analysis for Unmanned Aerial System (UAS) Operations over Inhabited Areas. Queensland, Australia : Queensland University of Technology, 2007. AIAC12 - Twelfth Australian International Aerospace Congress, 2nd Australasian Unmanned Air Vehicles Conference, 19-22 Mar 2007.

4. NAWCAD Patuxent River Technical Report No. NAWCADPAX/TR-2012/195, Potential Crash Location Model, of 6 Jun 2012.

5. NAWCAD Patuxent River Technical Report No. NAWCADPAX/TR-2012/194, Population Density Modeling Tool, of 26 Jun 2012.

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